

# South Dakota AFNR

## *Academic Integration Activities: Example #3*

→ *Ag Metal Fabrication students use geometry shapes to determine how to cut and bend metal to create metal box projects.*

### **1. Ag Standard**

*Ag Metal Fabrication—AMF1.2*

Prepare different types of metal for welding.

- > Bend, shape, file, and grind metals.

### **2. Academic Standard**

*9-12.G.2.1*

Students are able to recognize the relationship between a three-dimensional figure and its two-dimensional representation.

- > Which of the following will fold into a cube?

### **3. Background Information**

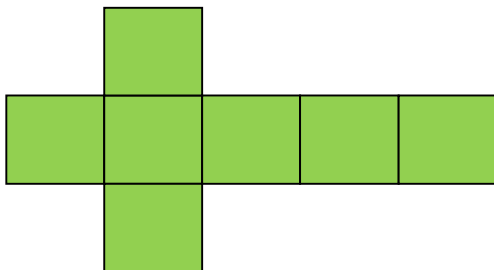
#### **Steps to Make a Net Diagram of a Box**

- Start with six squares since there are six sides to a cube.
- Arrange the six squares so they fold into a cube.
- Think of a cube as four sides, a top, and a bottom.
- First choose one square to be the base of the cube in your mind.
- Then imagine the sides folding up around the base.
- The last square should flip over to be the top of the cube.

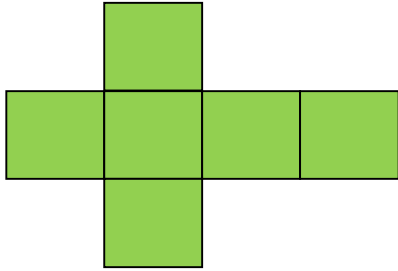
### **4. Example in Context**

Students are asked to create a small box by bending and shaping metal. They first diagram their box design on paper to determine how it will fold. Using geometry knowledge, they will create a model that will fold into a box.

Student A creates this design. He cuts out the paper model and practices folding it to ensure his diagram will work.



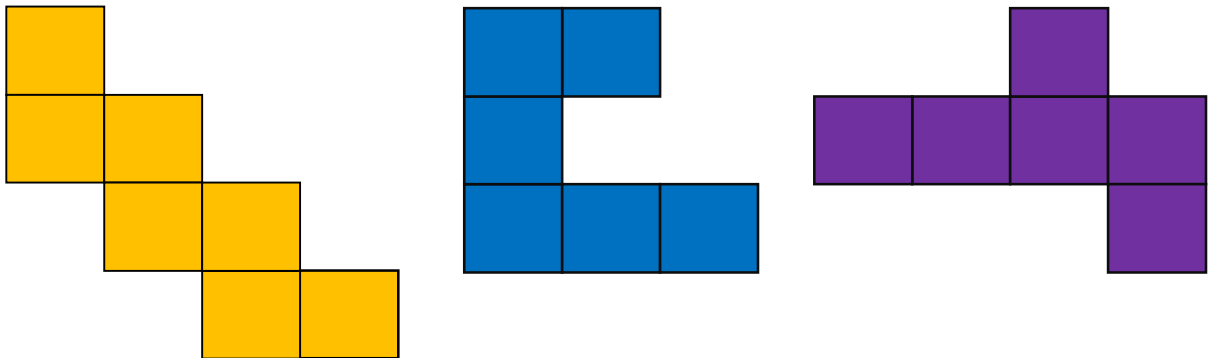
After he tries folding this model, he realizes he has one too many squares. He only needs six. He tries again by cutting off one square cube of the paper.



This time the paper folds perfectly into a box. He can now lay this paper model onto the metal and trace around the outline. He also can measure the dimensions of the boxes to make marks on the metal for the appropriate bends.

## 5. Guided Practice Exercises

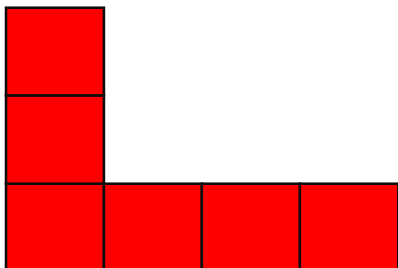
An Ag Metals teacher assigns students to build a pencil-box by bending and shaping metal. She provides a worksheet that includes various possibilities to use to make the box. Students must choose which model would accurately fold into a square box. Once students have selected the correct diagram, they will enlarge the dimensions to create a pencil-box. Which diagram should they use?



*Answer: Students should use the purple figure because it folds into a box.*

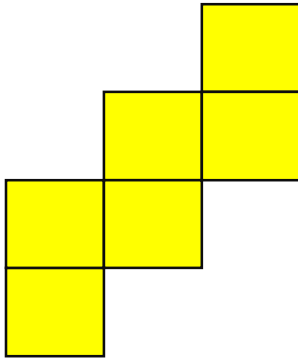
## 6. Independent Practice Exercises

Student X sketches the following diagram to use for his metal box project. If he uses this diagram, will his metal fold into a box?



*Answer: No, there will be overlapping sides.*

Student Y sketches the following diagram to use for his metal box project. If he uses this diagram, will his metal fold into a box?



*Answer: Yes, there is the correct number of squares, and they each fold to represent one side of the box.*

## 7. Notes

During an Ag Metals class, these geometry figures could be used in a variety of ways:

- > Students sketch diagrams and cut out of paper to practice basic skill of understanding the folds.
- > Students are provided various correct and incorrect diagrams to test.
- > Students sketch diagrams and use them to create a metal bending project.
  - Lay diagram on metal and trace it.
  - Measure dimensions of diagram, adjust to desired size, and mark dimensions on metal.
- > Students are provided with a worksheet that contains hypothetical situations to use these shapes for metal bending. Students determine which examples would and would not work.

Alternative: Instead of using paper to create the diagrams, sketch them on thin cardboard, such as a cereal box. Paper may be too flimsy for this type of project.